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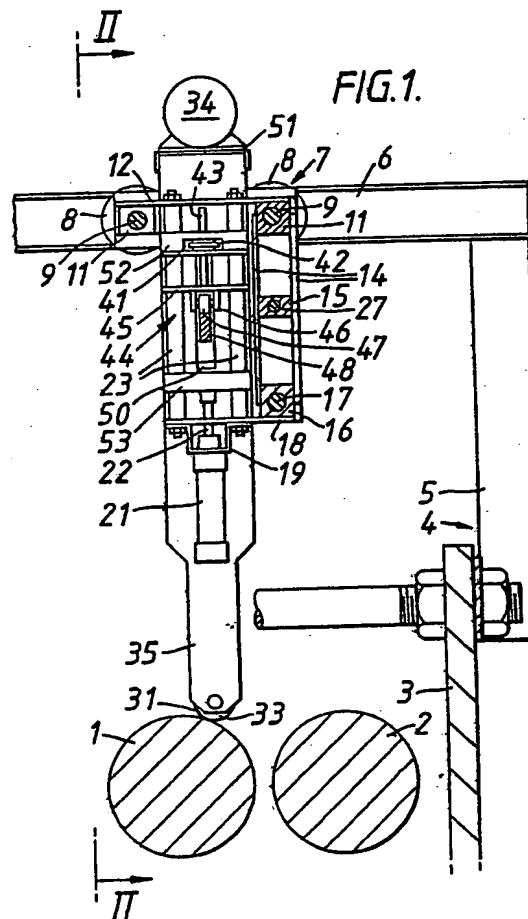
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GB 1501669 GB 0314943
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B3D
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(54) Grinding burnishing or similarly treating the surface of a rotatable workpiece

(57) Apparatus for grinding, burnishing or similarly treating the surface of a rotatable workpiece such as a work roll *in situ* comprises an abrading, burnishing or like member having an arcuate surface movable into contact with the workpiece surface and includes a roller adapted to travel along a template profiled to correspond to the described surface profile of the workpiece to move the member along a path which follows the desired surface contour of the workpiece. Relative rotation is effected between the arcuate surface of the member and the workpiece to grind, burnish or similarly treat the surface thereof.



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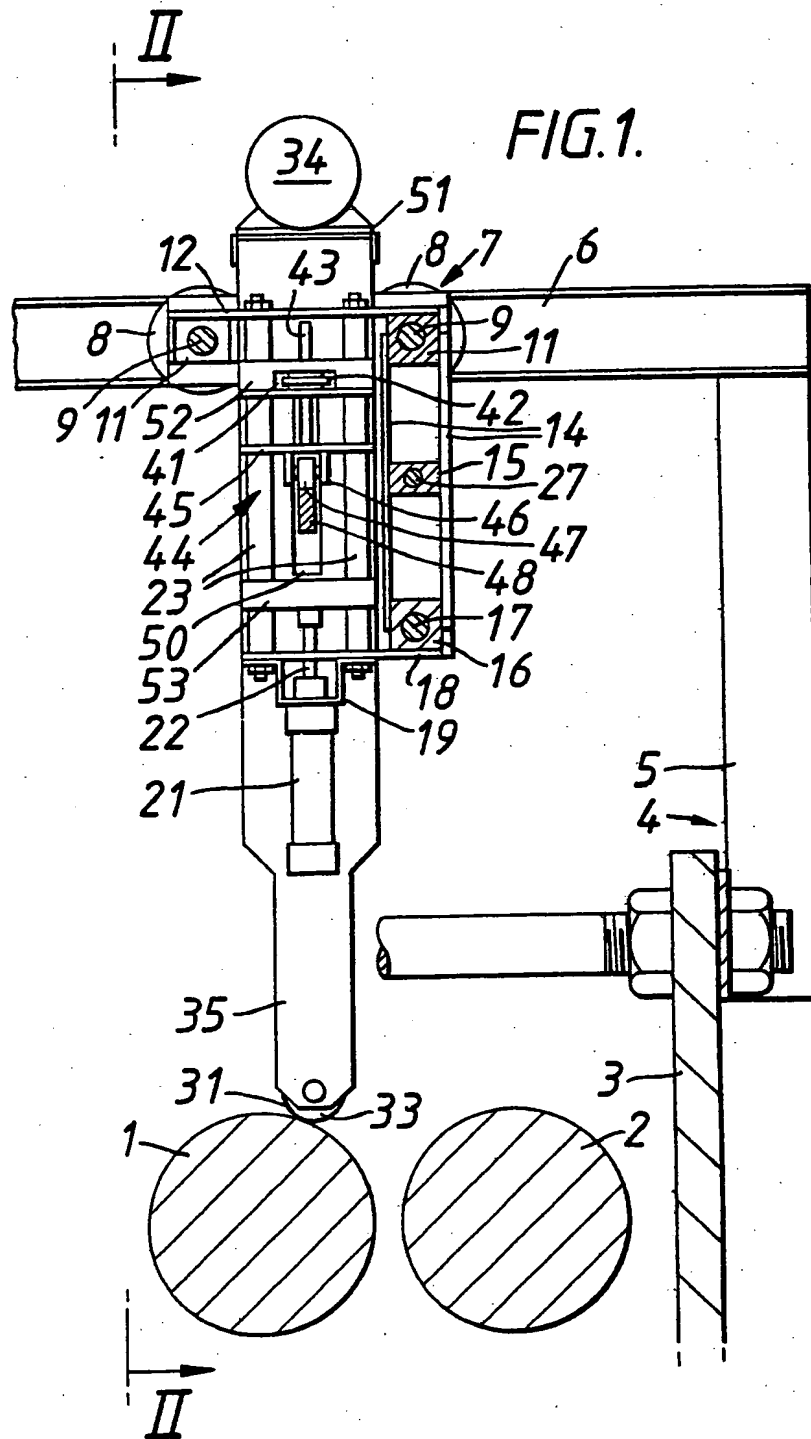
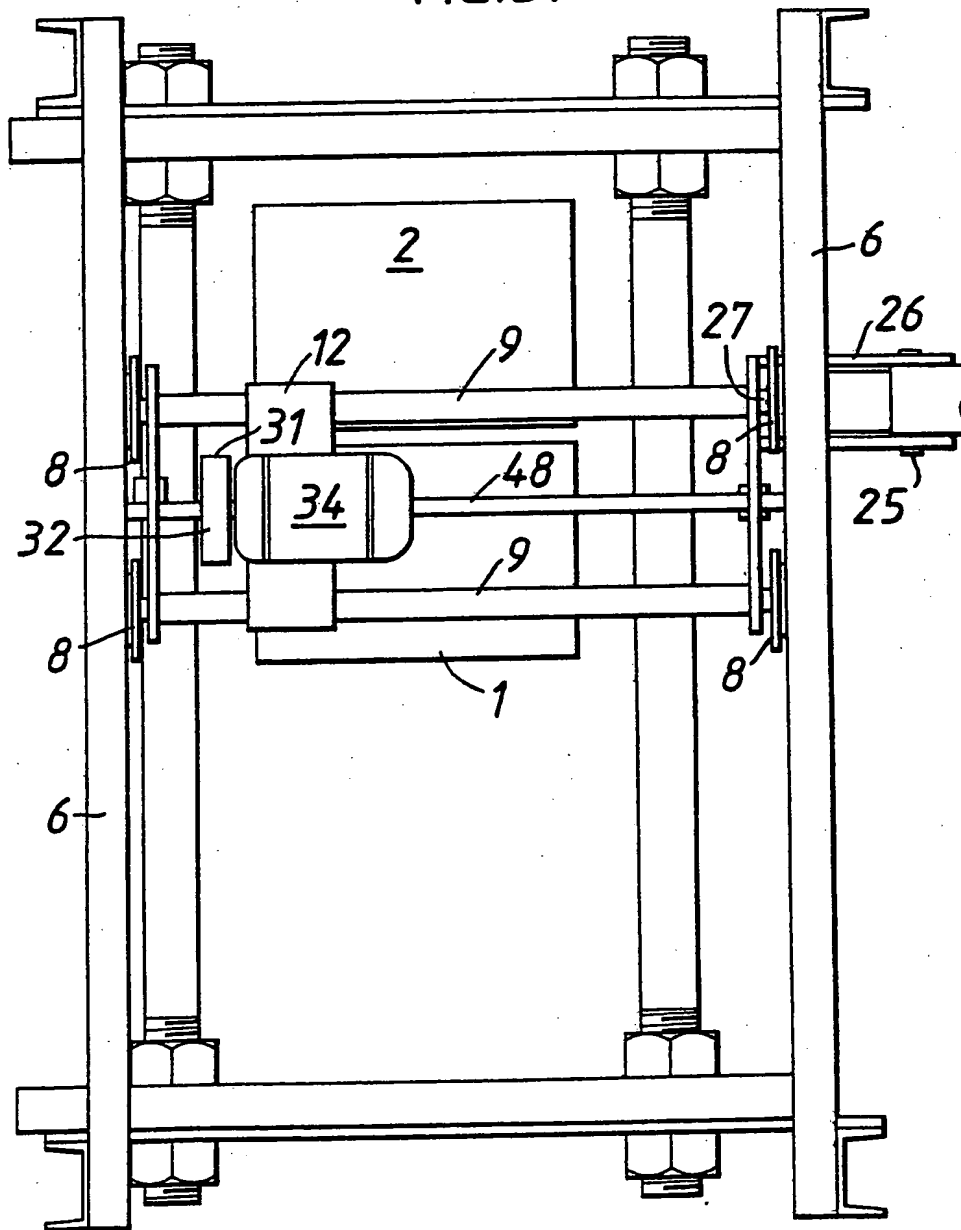


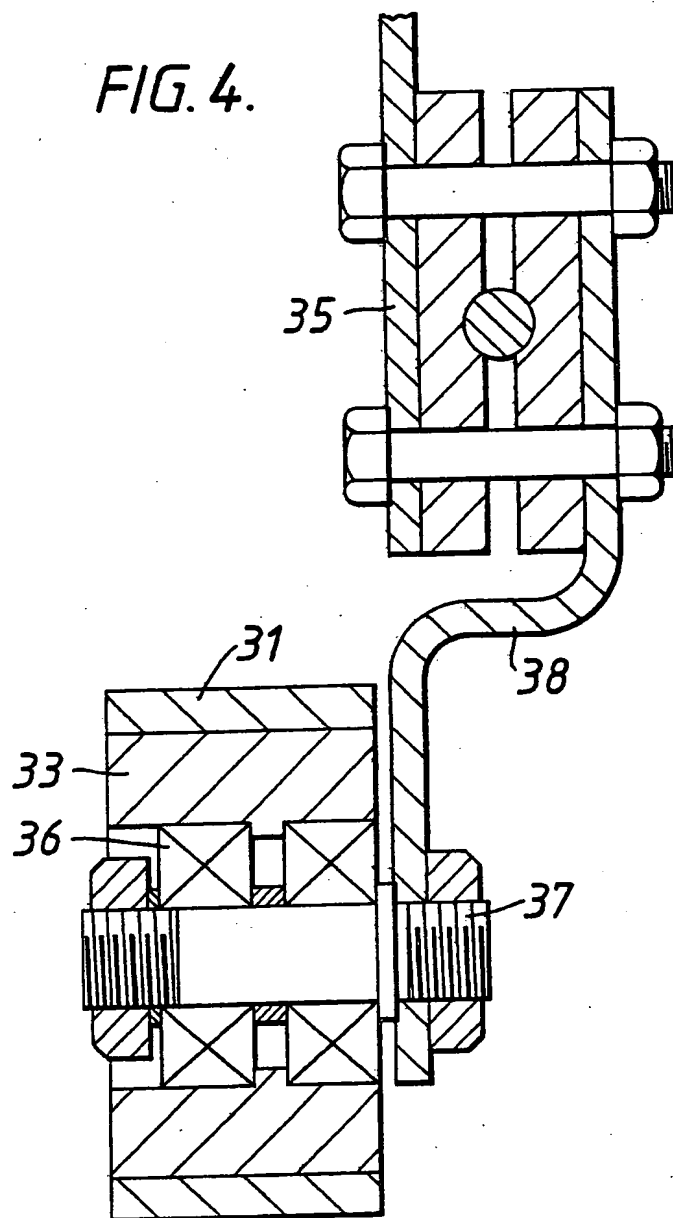


FIG. 3.



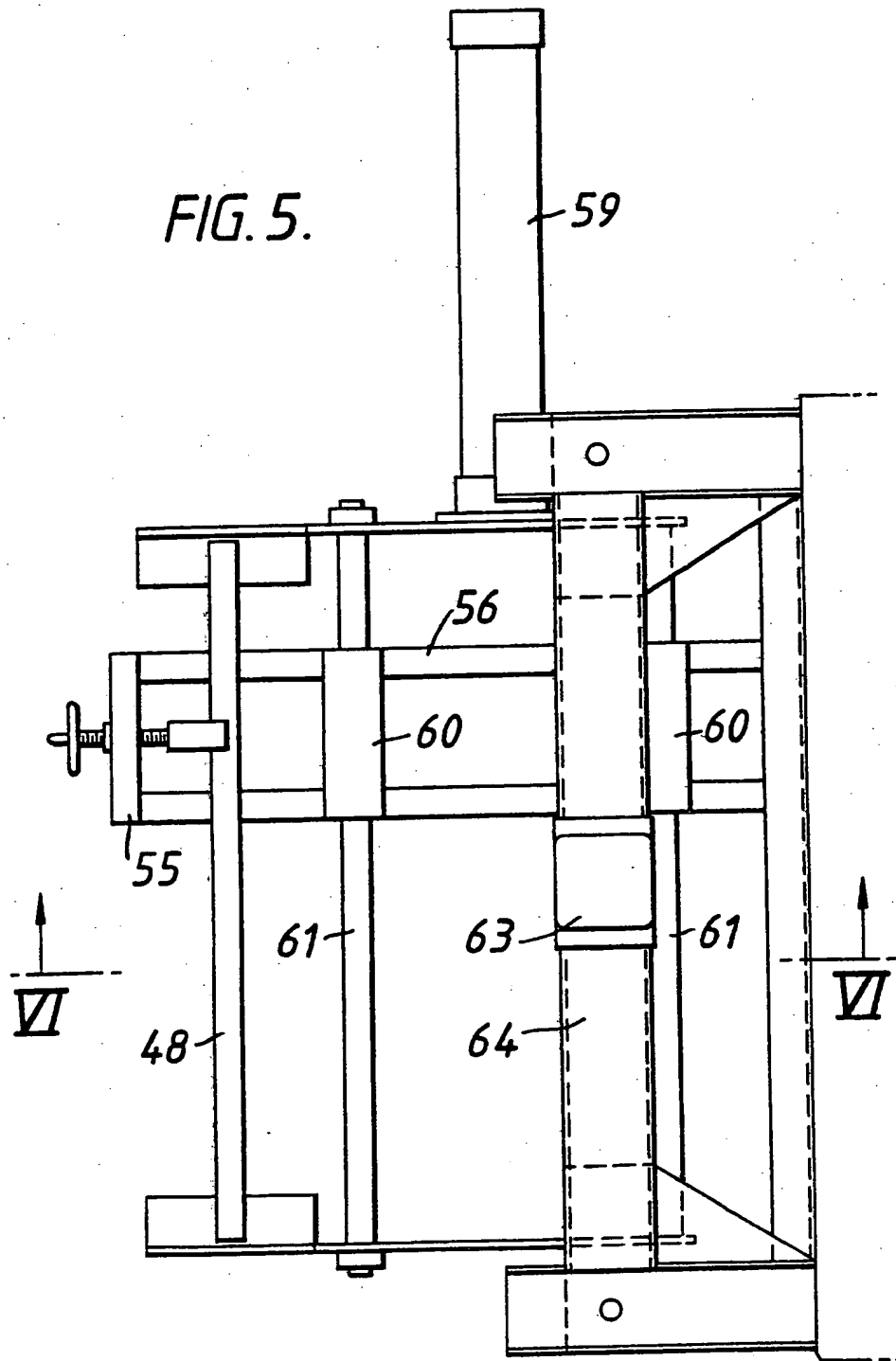
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FIG. 4.

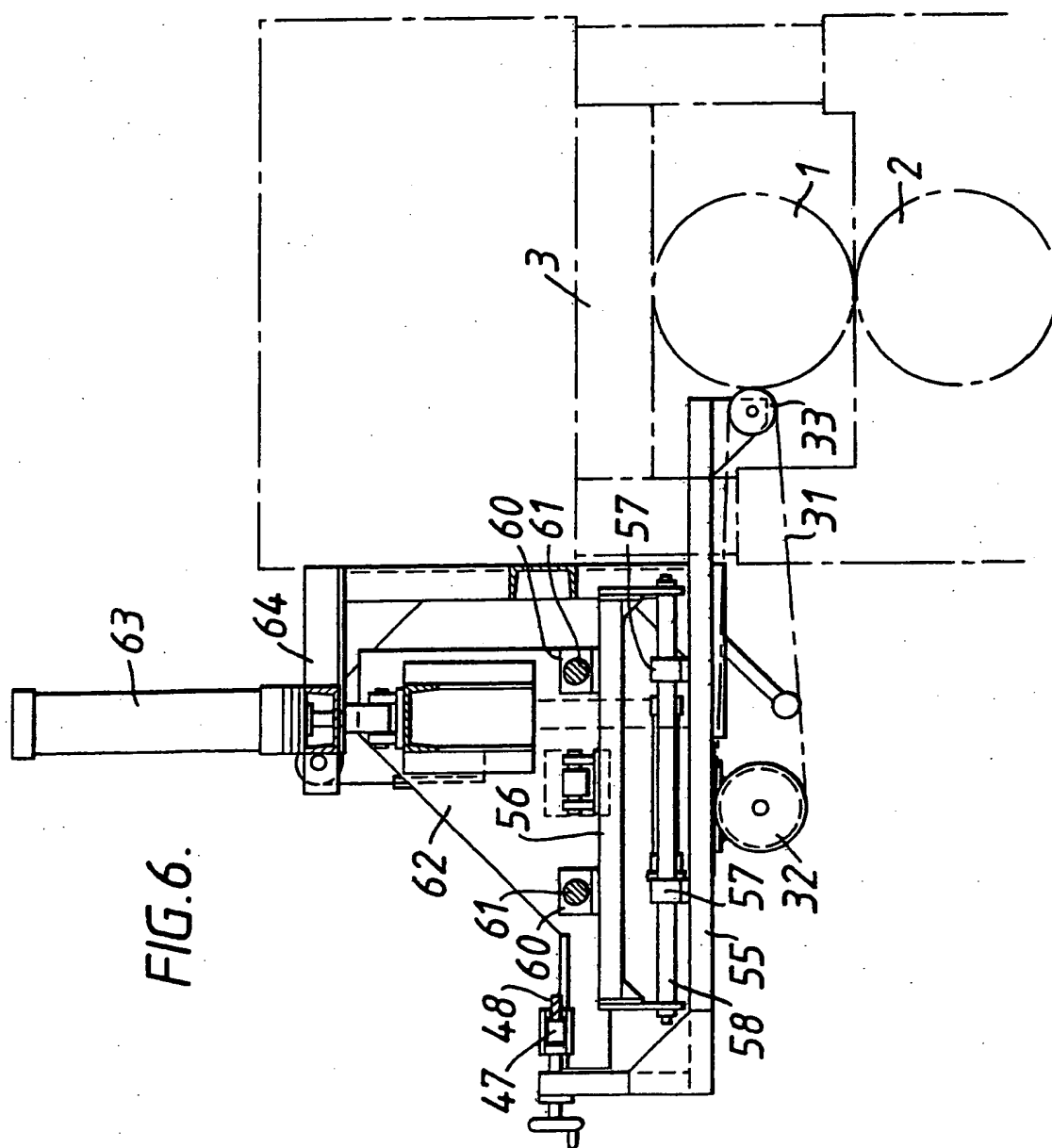


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FIG. 5.



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SPECIFICATION

Improvements in and relating to the treatment of the surface of a rotatable workpiece

- 5 This invention relates to methods of and apparatus for burnishing grinding or similarly treating, the surface of rotatable workpieces such as work rolls for use in rolling machinery.
- 10 From time to time, it is necessary to polish and/or surface grind work rolls in order to maintain their required finish and profile. Hitherto, these operations have been carried out either manually with the rolls *in situ* or mechanically with the rolls removed from the rolling machine. The former operation is hazardous and the latter time consuming and costly. Polishing is frequently necessary for work rolls, such as reeler rolls, used for rolling and/or straightening stainless steel and non-ferrous products.
- 20 According to the present invention in one aspect there is provided apparatus for grinding, burnishing or similarly treating the surface of a rotatable workpiece such as a work roll *in situ*, comprising an abrading, burnishing or similar member having an arcuate surface movable into contact with the workpiece surface and including means adapted to co-operate with a former or template profiled to correspond to the desired surface profile of the workpiece to move said member along a path which follows the desired surface contour of the workpiece, and means operable to effect relative rotation between the arcuate contact surface of the member and the surface of the workpiece to grind, burnish or similarly treat the surface thereof.
- 35 The abrading, burnishing or similar member preferably comprises an endless belt surfaced with a suitable material which travels around a pair of spaced wheels, one of which is movable with the arcuate belt surface at any one time disposed about the circumference of the wheel into edge contact with the workpiece surface. Alternatively, the member may comprise a disc movable into edge contact with the workpiece surface.
- 40 In a preferred arrangement, the endless belt and spaced wheels are mounted on a structure which includes a roller adapted to travel along the former or template profile to cause the member to follow the surface contour of the workpiece. The member may be supported by a structure which is movable relative to the workpiece to enable the roller to travel along the former or template.
- 45 The endless belt may be moved by electro-mechanical, pneumatics or hydraulic means towards and away from the workpiece to move the arcuate contact surface into and out of contact with the workpiece surface.
- 50 The abrading or burnishing member may be so mounted that it approaches the workpiece from above or from one side thereof.
- 60 According to the present invention in another aspect, there is provided a method of grinding, burnishing or similarly treating the surface of a rotatable workpiece *in situ*, which method comprises the steps of moving an arcuate surface of an abrading or burnishing or similar member into

contact with the workpiece surface, effecting relative rotation between the arcuate surface and the workpiece surface and moving said member along a former or template having a profile corresponding to the desired surface profile of the member whereby the arcuate contact surface of the member follows the desired surface contour of the workpiece.

The invention will now be described by way of example only with reference to the accompanying diagrammatic drawings, in which:-

75 *Figure 1* is a sectional view of apparatus in accordance with the invention taken along line I-I of *Figure 2*;

Figure 2 is a sectional view taken along line II-II of *Figure 1*;

Figure 3 is a plan view from above of the apparatus illustrated in *Figures 1* and *2*;

Figure 4 is a sectional view of a contact wheel of the apparatus illustrated in *Figures 1* to *3*; and

85 *Figures 5* and *6* are respectively a plan and a side elevational view taken along line VI-VI of *Figure 5* of alternative apparatus in accordance with the invention.

The apparatus illustrated in *Figures 1* to *4* comprises a polishing tool for burnishing the surface of a pair of straightener rolls used in the manufacture of steel and non-ferrous elongate products. The work rolls 1, 2 are inclined to the horizontal in opposite senses. The roll housing is schematically illustrated at 3. Supported on the housing and above the rolls is a frame 4 including four upstanding steel support legs 5 and two channelled cross beams 6 which together define a track for a carriage 7.

The carriage 7 has two pairs of flanged wheels 8 which track within the channels of the cross beam 6. The wheels of each pair are connected through tie bars 9 which support slide blocks 11. The blocks 11 are joined together through a top plate 12. Side plates 14 are secured one to each side of the right hand slide block (as illustrated in *Figure 1*); the side plates 14 serve to support a block 15 and are secured at their lower ends to a further slide block 16 which is located about a bottom tie bar 17. The slide block 16 seats upon a bottom plate 18, to the underside of which is secured a bracket 19 for supporting a pneumatic cylinder 21 having a drive rod 22. Vertical slide bars 23 extend between and are connected to the top and bottom plates 12, 18.

The carriage assembly can be moved along the tie bars 9, 17 by a pneumatic cylinder connected through a pivot pin 25 to the side plates of a trunnion 26. Secured to the back plate of the trunnion is a rod 27 which passes through and is secured to the remote face of the block 15.

120 The polishing tool includes an endless belt 31 surfaced with a selected coating or material which tracks about upper and lower wheels 32, 33. The upper wheel 32 is mounted on the drive spindle of an electric motor 34 and the lower contact wheel 33 is connected to the lower end of a backing plate 35 in the manner shown in *Figure 4*. As will be seen from this *Figure*, the wheel bearings 36 are supported on a spindle 37 secured to a shaped support plate 38 which is, in turn, secured to the backing plate 35.

130 The backing plate 35 has a central 'T' shaped slot

50 and is formed at its upper end with a horizontal platform 51 upon which the electric motor 34 is mounted. Secured to the front face of the plate 35 are upper and lower bearing housings 52, 53 through which pass the vertical slide bars 23. The upper housing 52 has a horizontal slot 41 within which seats a retaining disc 42 secured to a vertical sleeve 43 of a roller support bracket 44. The bracket 44 includes a horizontal plate 45 through which the slide bars 23 pass. Welded to the underside of the plate 45 are side pieces 46 which together support the spindle of a roller 47. Thus, the roller 47 is suspended from the upper housing 52. The lower housing 53 seats upon and is supported by the free end of the rod 22 of the pneumatic cylinder 21.

The roller 47 tracks over the surface of a former 48 which passes through the central slot 50 of the backing plate 35. As will be seen from Figure 2 the former 48 is inclined so that its surface lies parallel to the roll surface to be polished. For rolls having shaped contours (e.g. concave or convex), the former profile is shaped to follow precisely the roll contour. The former is supported within retaining blocks 49 whose positions can be varied to change the inclination of the former 48.

From the foregoing, it will be appreciated that the polishing tool comprising the endless belt 31; the wheels 32, 33; the electric motor 34 and the backing plate 35 with its bearing housings 52, 53 can be moved vertically relative to the work rolls 1, 2 and to its support structure comprising the carriage 7, slide blocks 11, 15 and vertical slide bars 23 either through operation of the pneumatic cylinder 21 or through uphill or downhill travel of the roller 47 along the former 48.

Additionally, the support structure can be moved across the tie bars 9, 17 through operation of the pneumatic cylinder connected through the trunnion 26 to the rod 27 to position the polishing tool assembly above a selected location along the length of the roll surface to be polished. Further, the carriage 7 can be moved along the track defined by the cross beam 6 to locate the polishing tool above separate rolls.

When the polishing tool is required, the carriage 7 is moved along the track defined by the channelled cross beams 6 until the tool is positioned above and to one side of the roll to be polished. The pneumatic cylinder connected to the trunnion 26 is then operated to site the contact wheel 33 above one extremity of the roll surface by movement of the slide blocks 11, 16 along the tie bars 9, 17. Once in position, the pneumatic cylinder 21 is activated to move the backing plate assembly downwards until the arcuate belt portion disposed around the contact wheel lies in contact with the roll surface. At the same time, or shortly thereafter, the work roll drive is activated to rotate the work roll and the motor 34 operated to cause the endless belt to travel about the circumference of the wheels 32, 33. The speed of rotation of the driven wheel 32 is such that there is relative movement between the contacting surfaces of the work roll and the belt. The support structure for the polishing tool is then moved slowly along the tie bars by the rod 27 connected to the trunnion 26 so

polishing the entire roll surface.

In an alternative arrangement, illustrated in Figures 5 and 6, the polishing tool is mounted to one side of the rolling machine rather than above it as described above.

In this embodiment (in which like integers to those illustrated in Figures 1 to 4 bear the same reference numerals), the wheels 32, 33 about which the surfaced belt 31 tracks are spaced in a horizontal sense and the roller 47 is mounted for rotation about a vertical axis and is urged into contact with the template surface of the former 48 to cause the belt portion tracking around wheel 33 to follow the desired contour of the work roll. The assembly of the wheels 32, 33, the drive motor for wheel 32 and the belt 31 is carried by a frame 55 suspended below a carriage 56 through slide blocks 57 located about tie bars 58. Thus, interaction between the roller 47 and the former 48 causes the frame 55 and, consequently, the surfaced belt 31 to move towards and away from the work rolls to follow the surface contour thereof.

The carriage 56 includes slide blocks 60 located about tie bars 61 supported between opposite sides of a housing 62 to enable the carriage 56 and, therefore, the frame 55 to be moved by a pneumatic or hydraulic cylinder 63 in a direction generally parallel to the rotational axes of the work rolls 1, 2. The housing 62 is movable vertically by means of a pneumatic or hydraulic cylinder 63 supported on fixed structure 64 to locate the surfaced belt adjacent the work roll to be treated.

It is to be understood that whilst the invention has been described with particular reference to a polishing tool for a rolling machine, the apparatus can equally well be employed for grinding or otherwise treating the surfaces of any suitable rotatable workpiece.

105 CLAIMS

1. Apparatus for grinding, burnishing or similarly treating the surface of a rotatable workpiece such as a work roll *in situ*, comprising an abrading, burnishing or like member having an arcuate surface movable into contact with the workpiece surface and including means adapted to co-operate with a template profiled to correspond to the desired surface profile of the workpiece to move said member along a path which follows the desired surface contour of the workpiece, and means operable to effect relative rotation between the arcuate contact surface of the member and the workpiece to grind, burnish or similarly treat the surface thereof.
2. Apparatus as claimed in claim 1 wherein the abrading, burnishing or like member comprises an endless belt surfaced with a suitable material which travels around a pair of spaced wheels, one of which is moveable with that portion of the belt at any one time disposed about its circumference into edge contact with the workpiece surface.
3. Apparatus as claimed in claim 1 wherein the abrading, burnishing or like member comprises a disc moveable into edge contact with the workpiece surface.

4. Apparatus as claimed in claim 1 or claim 2 wherein the endless belt and spaced wheels are mounted on a structure which includes a roller adapted to travel along the template profile to cause the member to follow the surface contour of the workpiece.

5. Apparatus as claimed in claim 4 wherein the member is supported by a structure which is moveable relative to the workpiece to enable the roller to travel along the template.

6. Apparatus as claimed in any one of claims 1, 2, 4 and 5 wherein the endless belt is moved by electro-mechanical, pneumatic or hydraulic means towards and away from the workpiece to move the arcuate contact surface into and out of engagement with the workpiece surface.

7. A method of grinding, burnishing or similarly treating the surface of a rotatable workpiece *in situ*, which method comprises the steps of moving an arcuate surface of an abrading, burnishing or like member into contact with the workpiece surface, effecting relative rotation between the arcuate surface and the workpiece surface and moving said member along a template having a profile corresponding to the desired surface profile of the member whereby the arcuate contact surface of the member follows the desired contour of the workpiece.

8. Apparatus for grinding, burnishing or similarly treating a workpiece substantially as herein described and as illustrated with reference to Figures 1 to 4 of the accompanying drawings.

9. A method of grinding, burnishing or similarly treating a workpiece substantially as herein described and as illustrated with reference to Figures 1 to 4 of the accompanying drawings.